Brief Communication

Cesarean sections. *Associated factors and frequency at King Abdulaziz Medical City in the Central Region of the Kingdom of Saudi Arabia*

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ABSTRACT

Objectives: To study the associated factors for cesarean section (C-section) in a sample of pregnant women and to estimate its frequency at King Abdulaziz Medical City in Riyadh, Kingdom of Saudi Arabia (KAMC-R).

Methods: We studied 364 pregnant women who attended the Gynecology and Obstetrics Clinic at KAMC-R between March and June 2017.

Results: Our 3-month study had higher rates of C-sections: women with older maternal age; (adjusted risk ratio [aRR]=1.08, p=0.001), lack of education (aRR=1.39, p=0.022), no personal history of vaginal delivery (aRR=1.85, p=0.001), undergoing C-section due to medical indications (aRR=2.28, p=0.001), and willing to repeat a C-section in the absence of medical indications (aRR=1.49, p=0.006). Cesarean section occurred in 27% of the total deliveries in 2016.

Conclusion: Cesarean section are very frequent and prevalent in our center, and may be increasing. The frequency of C-sections was significantly higher for women of older maternal age, little education, no personal history of vaginal delivery, undergoing C-sections due to medical indications, and those willing to repeat a C-section in the absence of medical indications.

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The frequency of cesarean section (C-section) delivery has increased worldwide and some of these procedures may be unnecessary cesarean deliveries.[1-3] A recent worldwide study that gathered data between 2005-2012 from 194 countries (all World Health Organization [WHO] member states) reported a prevalence of 19% C-sections out of all deliveries.[4] The prevalence of cesarean deliveries is widely documented in the Kingdom of Saudi Arabia (KSA), ranging from 4-41%, depending on the delivery practice, hospitals, and regions.[5-8]

Cesarean section is prevalent in our center (King Abdulaziz Medical City in Riyadh, KSA). It has been reported that there were 19.1% C-sections of all 22,595 deliveries from June 2008 to February 2011. However, according to the hospital records, this rate has risen dramatically to 27% in 2016.[6] The rate in our center exceeded what the WHO has suggested, where 15% is considered the acceptable rate.[9] Studies are warranted to understand and evaluate the factors associated with the high frequency of C-sections and to develop programs or guidelines to reduce C-section rates while keeping maternal and neonatal safety.

Studies from various regions of the globe reported several factors associated with the high rate of C-sections. Most of these studies on C-section factors have focused on binary outcome whether or not women had a C-section rather than the frequency of associated factors for C-sections. For instance, authors had shown that the odds of C-sections have increased with maternal age.[10-15] An assessment of how pregnant women's characteristics affect the frequency of C-sections remains inadequately described.

The study investigated whether the following factors are more likely to increase the rate of C-section: old maternal age, little education, undergoing C-section due to medical indications, and willingness to repeat C-section in the absence of medical indications. The purpose of this study was to identify the contributing factors for C-sections in a sample of pregnant women and to examine its frequency at King Abdulaziz Medical City in Riyadh, KSA.

Methods. This cross-sectional study was approved (#RC17/051-R) by the Institutional Review Board (IRB) at King Abdullah International Medical Research Center (KAIMRC) in Riyadh, KSA. The study population was pregnant women who attended the Gynecology and Obstetrics Clinic at King Abdulaziz Medical City in Riyadh, KSA between March -June 2017 for a routine pregnancy follow-up. Women were asked whether they were planning on undergoing a C-section for the current pregnancy. Women planning or undergoing vaginal delivery were excluded from the study. A total of 440 women who were planning or undergoing a C-section were asked for their consent to participate in the study, and 364 consented in writing to participate, with a response rate of 364/440 (82.7%). The study

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questionnaire included women's socioeconomic and clinical data: age, university degree holder, income levels ($1=SR3.75), nationality, employment status, personal history of vaginal delivery, whether received education or medical information on the possibility to deliver by C-section, undergoing C-section due to medical indications, and willing to repeat C-section in the absence of medical indications. Medical indications were classified according to the presence of one or more of the following reasons: multiple pregnancies, small maternal pelvic, abnormal fetal lie and presentation, high or low birth weight, maternal infection, life threatening complication of pregnancy, placenta previa, none reassuring fetal monitoring, history of failed progress of labor, and previous multiple C-sections.

Our outcome was to assess the frequency of each woman's previous cesarean deliveries. Women were asked to report the number of previous cesarean deliveries. A *p*-value ≥0 was considered a possible response, namely, 0 indicates no previous cesarean deliveries, 1 indicates one previous cesarean delivery, 2 indicates 2 previous cesarean deliveries. We also presented hospital records on total deliveries and frequency of cesarean deliveries from January 2010 through December 2016.

Statistical analysis. Descriptive, bivariate, and multivariate analyses were carried out using SPSS version 24 (IBM Corp., Armonk, NY, USA). Numerical characteristics were presented as mean±standard deviation, minimum, and maximum. Categorical characteristics were presented as frequency and percentage (**Table 1**). Modeling count data was used to estimate the rate of C-sections and to identify the associated factors. Generalized estimating equations with Poisson and negative binomial distributions were considered and assessed using the deviance (a *p*-value=1 would be best) and Akaike Information Criterion (AIC) (the smaller the better) to find the best model. Poisson Bivariate and Poisson Multivariate models were used to identify factors associated with a greater rate or lower rate of C-sections (**Table 2**). Risk ratio (RR) estimate and 95% confidence intervals (CI) were used to interpret whether the rate increased or decreased in the frequency of C-section. Factors were considered significant at a *p*-value of <0.05.

Table 1 - Sample characteristics of the study (N=364).

Characteristics	n (%)
University degree	
Yes	180 (52.0)
No	166 (48.0)
Income ($ 1 ≈ SR 3.75)	
No income or <SR5000	34 (10.2)
SR 5000-10000	283 (85.0)
>SR 10000	16 (4.8)
Nationality	
Saudi	333 (96.2)
Non-Saudi	13 (3.8)
Employed	
Yes	95 (27.4)
No	252 (72.6)
Family history of C-section	
Yes	41 (12.5)
No	286 (87.5)
History of vaginal delivery	
Yes	142 (40.0)
No	213 (60.0)
Received education or medical information on the possibility to deliver by C-section	
Yes	301 (82.7)
No	63 (17.3)
Undergoing C-section due to medical indications	
Yes	314 (86.3)
No (on maternal request)	50 (13.7)
Willing to repeat C-section in absence of medical indications	
Yes	79 (24.5)
No	243 (75.5)
Frequency of C-sections	
0	126 (37.5)
1	92 (27.4)
2	67 (19.9)
3	36 (10.7)
4	8 (2.4)
5	7 (2.1)

C-section - cesarean section.

Results. The sample mean age was 32.3 years (range 16-45 years. Of the 364 women planning C-section as a mode of delivery for the current pregnancy, 142/355 (40%) had a personal history of vaginal delivery, 180/346 (52%) had a university degree, 34/333 (10.2%) had no income or income of less than 5000 SR ($1=SR3.75) (**Table 1**). Of the sample, 50/364 (13.7%) were planning C-sections without medical indication and 79/322 (24.5%) were willing to repeat a C-section in absence of medical indications. The C-section rate at King Abdulaziz Medical City in Riyadh, KSA has increased since 2010 when the rate was 20.3%. In 2015-2016, the rate was the highest recorded at 27% (**Figure 1**).

The frequency of C-sections was reported in **Table 1**.

Simple Poisson models (**Table 2**) showed women with older age (risk ratio [RR]=1.06, *p*=0.001), lack of education (RR=1.37, *p*=0.003), women with low income (RR=1.85, *p*=0.002), no personal history of vaginal delivery (RR=1.43, *p*=0.001), and undergoing a C-section due to medical indications (RR=1.70, *p*=0.003) were associated with the lower rate of

Table 2 - Factors associated with high rate of cesarean section (C-section).

Characteristics	Bivariate analysis				Multivariate analysis			
		95% CI		*P*-value		95% CI		*P*-value
	RR	Lower	Upper		aRR	Lower	Upper	
(Intercept)	0.17	0.092	0.302	0.001	0.02	0.005	0.100	0.001
Age	1.06	1.044	1.082	0.001*	1.08	1.053	1.101	0.001*
University degree	0.73	0.599	0.898	0.003*	0.72	0.539	0.953	0.022*
No income or <SR5000	0.80	0.494	1.297	0.365	1.48	0.785	2.779	0.226
Income SR5000-10000	0.54	0.368	0.799	0.002*	0.92	0.547	1.548	0.754
Saudi nationality	1.60	0.828	3.106	0.162	2.36	0.949	5.865	0.065
Employed	1.12	0.897	1.398	0.316	0.98	0.712	1.338	0.880
Family history of C-section	0.84	0.595	1.185	0.320	0.51	0.297	0.891	0.018*
History of vaginal delivery	0.70	0.565	0.861	0.001*	0.54	0.413	0.701	0.001*
Received education or medical information on the possibility to deliver by C-section	1.11	0.849	1.464	0.435	1.46	0.970	2.208	0.069
Undergoing C-section due to medical indications	1.70	1.202	2.406	0.003*	2.28	1.445	3.604	0.001*
Willing to repeat C-section in absence of medical indications	1.25	0.997	1.577	0.053	1.49	1.119	1.989	0.006*

*Significant at α=0.05. C-section - cesarean section, SR - Saudi Riyals, CI - confidence interval, RR - risk ratio, aRR - adjusted risk ratio

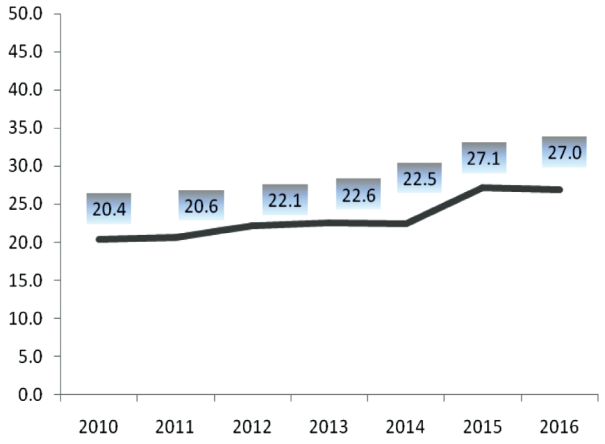

Figure 1 - Percentage of deliveries by cesarian sections at King Abdulaziz Medical City, Riyadh, Kingdom of Saudi Arabia.

C-sections. The multivariate Poisson regression model (**Table 2**) showed that the factors associated with the greater rate of C-sections were women with older maternal age (aRR=1.08, *p*=0.001), lack of education (aRR=1.39, *p*=0.022), no personal history of vaginal delivery (aRR=1.85, *p*=0.001), undergoing C-section due to medical indications (aRR=2.28, *p*=0.001), and willing to repeat C-section in the absence of medical indications (aRR=1.49, *p*=0.006).

As compared to the negative binomial model, the Poisson model fit the data well. The Poisson model had a deviance value of slightly more than one compared to the negative binomial regression model (1.18 versus 0.66). The AIC was smaller for the Poisson regression model compared to the negative binomial regression model (657 versus 715).

Discussion. A review of research studies that published factors associated with C-sections indicates that solid conclusions may not be made, because these studies modeled a binary outcome (C-section Yes/No), where they identified factors associated with greater odds of C-section.[10,12,14] In our center, the C-sections performed accounted for 20.4% (1733/8499) of all of deliveries in 2010. This rate has steadily increased to 27% (2307/8557) of all of deliveries in 2016; 33.1% of the increase can be attributable to an increase in the frequency of C-sections.

The study found that there is a marked increase in the frequency of C-section with increasing age. As age increases by one year, the rate of C-section increases by 8%. Other studies have also demonstrated that higher odds of C-section are associated with older maternal age.[11,13,15] Such findings can be explained by the fact that older women are at high risk of pregnancy-related complications, which may lead to a C-section. The pregnancy in women with older age>35 must be carefully monitored.

The major finding of our study is that the frequency of C-sections was significantly higher for women who are willing to repeat C-section in the absence of medical

indications. The rate of C-sections is a 49% increase in women willing to repeat C-sections in the absence of medical indications compared to those who are not willing to repeat C-sections in the absence of medical indications. In line with this finding, women with no university degree positively contributed to the high rate of C-section, an increase of 38.9% as compared to women with a university degree. We speculate that improving pregnant women's attitudes and knowledge toward the frequency of C-sections and their risks may reduce the rate of C-sections.

Study limitations. The findings may not be generalized, as the study represents pregnant women who were attending the Gynecology and Obstetrics Clinic at King Abdulaziz Medical City in Riyadh, KSA and were planning on undergoing a C-section. The significant findings represent association, not causation, and it should be interpreted with caution due to the nature of our study design (cross-sectional). Despite the mentioned limitations, our study of frequency of C-sections and their associated factors is very informative, as there is no data available for women who have undergone previous C-sections.

In conclusion, C-sections are very frequent and prevalent in our center. The frequency of C-sections was significantly higher for women with older age, little education, no personal history of vaginal delivery, undergoing C-section due to medical indications, and willingness to repeat a C-section in the absence of medical indications. Ultimately, improving pregnant women's attitudes and knowledge toward the frequency of C-sections and its risks are needed to reduce the rate of C-sections. An interventional study is needed to assess the effectiveness of guidelines or programs on reducing the frequency of C-sections.

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